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Notes from the NICU: Analyzing the Chemical Content of Commonly Used Medical Products

Nate Seltenrich

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Neonatal intensive care units (NICUs) are tasked with saving the lives of some of society's most vulnerable individuals. But while ill and premature newborn infants in the NICU benefit from the best care that modern hospitals have to offer, is there a chance these life-saving treatments also result in potentially harmful chemical exposures? That question is at the heart of a study published recently in *Environmental Health Perspectives*.[1]

The new study was performed by a research team based in Granada, Spain, in collaboration with a local NICU. The investigators first collected a convenience sample of commonly used medical items such as film dressings, feeding tubes, intravenous systems, pacifiers, ointments, catheters, and sterile gloves. The 52 items were manufactured in countries around the world: 37 came from Europe, 8 from the United States, 6 from Asia, and 1 from New Zealand. Then the investigators prepared extracts to quantify the content of bisphenol A (BPA) and multiple parabens in each item and to assess hormone-like activity through *in vitro* assays.

BPA is used in the manufacturing of polycarbonate plastics and added to many other plastics such as polyvinyl chloride.[2] Parabens are often added to personal care products, pharmaceuticals, and certain plastics as antimicrobial preservatives.[3] Both compounds have been associated with a variety of adverse health outcomes in humans.[4]

The investigators found that many of the items contained one or more of the chemicals and exhibited *in vitro* estrogenic and/or antiandrogenic activity. For example, compared with other items evaluated, the clear section of the three-way stopcock, a hard plastic device used to control flow through intravenous and feeding tubes, contained relatively high concentrations of BPA but low concentrations of parabens. Patterned transparent film dressing, meanwhile, had high concentrations of both BPA and parabens, along with *in vitro* estrogenic activity.

Some of the items tested, such as the nipple of a small pacifier, were found to have higher levels of hormone-like activity than would be expected given the measured BPA and paraben concentrations. This suggests the presence of other endocrine-disrupting chemicals, such as phthalates, that were not assessed in the current study. Phthalates are commonly

A new study provides what is thought to be the first direct measurements of BPA and paraben content of medical items used widely in NICUs, as well as the *in vitro* hormone-like activity of these items. Image: © iStockphoto/racheldonahue.

used to increase the flexibility, transparency, durability, and longevity of plastics.[5]

The study did not measure the extent to which BPA or phthalates may leach from medical items into infants' bodies. However, the authors contend its findings suggest an urgent need to adopt precautionary measures to reduce or eliminate these potentially harmful exposures. "We already know that everybody is exposed [to BPA], but we have to do something special for this population that is very sensitive to any environmental impact," says senior author Nicolás Olea, a professor of medicine at the University of Granada.

To date, only two studies have assessed actual BPA exposures in NICU patients. The more recent study,[6] published in 2013, found 16- to 32-fold higher BPA concentrations in NICU infants compared with infants 1–5 months of age in the general population. An earlier study,[7] published in *EHP* in 2009, determined that urinary levels of BPA were 3.42 and 8.75 times higher in infants who experienced moderate and high intensity of medical device use, respectively, versus low intensity. As a point of reference, low intensity might include bottle feeding as opposed to enteral feeding (medium intensity) or continuous indwelling umbilical vein catheterization (high intensity). This study also found that infants exposed to the most products and devices had urinary methylparaben levels 2.48 times higher than infants exposed to the fewest items.

Russ Hauser, professor and chair of the Department of Environmental Health at the Harvard T.H. Chan School of Public Health, served as the senior author of the 2009 paper but was not affiliated with the new study. "What is novel in this paper is the use of laboratory methodologies to assess total estrogenicity of the chemicals in these products. This group of researchers led by Dr. Olea are pioneers in this regard," Hauser notes. "It is relatively more straightforward to take a product and measure the chemicals in it. But then to try and measure the biological activity—which ultimately is most relevant—is really an advance in terms of understanding the exposures that [NICU patients] may receive and whether they're exposed to estrogenic and/or antiandrogenic chemicals."

According to Wade Welshons, an expert in endocrine disruption and associate professor at the University of Missouri who also was not involved in the current study, the main takeaway is that difficult-to-predict medical items exhibit high hormone-like activity. "And it is not like you can refuse to use medical plastics and eliminate exposure because one is high and another is not," he says. "It is complicated to know how to avoid exposure to these [highly active items]."

The solution, suggests Olea, may not be simply to identify safer plastics, but rather to develop new treatment protocols that avoid them altogether. "This is something that has to be incorporated into the minds of clinicians," Olea says. "They are very afraid of bacteria or viruses or biological stress, but they have very little information about chemical stress."

Nate Seltenrich covers science and the environment from the San Francisco Bay Area. His work on subjects including energy, ecology, and environmental health has appeared in a wide variety of regional, national, and international publications.

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